REMARKS

Overview of the Office Action

The drawings have been objected to for not showing a reference numeral corresponding to an element described in the specification.

Claim 15 has been rejected under 35 U.S.C. §102(e) as anticipated by U.S. Patent Pub. No. 2003/0152125 to Kinoshita ("Kinoshita").

Claims 1-9 have been rejected under 35 U.S.C. §103(a) as unpatentable over Kinoshita in view of U.S. Patent Pub. No. 2002/0109148 to Shveykin ("Shveykin").

Status of the claims

Claim 15 has been amended.

Claims 10-14 have been previously withdrawn.

Claims 1-9 and 15 are now under examination.

Objections to the drawings

The drawings have been objected to for not showing a reference numeral corresponding to an element described in the specification.

The drawings have been amended to show element 14, which is described in Applicants' specification on page 10, line 6. No new matter has been introduced.

Applicants submit that this objection has now been overcome.

Summary of subject matter disclosed in the specification

The following descriptive details are based on the specification. They are provided only for the convenience of the Examiner as part of the discussion presented herein, and are not intended to argue limitations which are unclaimed.

Disclosed is a surface emitting semiconductor laser chip. The semiconductor laser chip includes a semiconductor body that includes a radiation exit face, a crystal structure that includes principal crystal directions extending along a lateral direction of the radiation exit face, and side faces laterally delimiting the semiconductor body. At least one of the side faces is disposed obliquely with respect to the principal crystal directions and disposed perpendicularly with respect to the radiation exit face.

Descriptive summary of Kinoshita

Kinoshita discloses a surface emitting laser, alleviated in reflection from facets of its active layer and waveguide layer with improved oscillation property that is configured not to make vertical side surfaces relative to the active layer or the waveguide direction. In VCSEL, side surfaces of the active layer are processed not to made vertical surfaces. In GCSEL, its crystalline surface orientation and its waveguide structure are chosen appropriately not to make upright surfaces on facets of the waveguide.

Descriptive summary of Shveykin

Shveykin discloses an injection incoherent emitter that outputs a directed beam of light resulting from spontaneous emission. The emitter provides small divergence angles and enhanced external efficiency, as well as increased energy and light power. Specific ranges of

compositions and thicknesses for layers and sublayers in the entire heterostructure, as well as for the layers of the emission output area may be employed to create this emitter. Different embodiments for the heterostructure and output areas permit emission from the emitters in different but controllable directions. One such direction is perpendicular to the active layer.

Claim 1 is allowable over Kinoshita in view of Shveykin under 35 U.S.C. §103(a)

The Office Action states that the combination of Kinoshita and Shveykin teaches all of Applicants' recited elements.

According to Applicants' independent claim 1, the semiconductor body of the surface emitting laser chip has side faces

(a) disposed obliquely with respect to crystal directions extending along a lateral direction of the radiation exit face, and

(b) perpendicularly with respect to the radiation exit face.

The Examiner concedes that Kinoshita does not teach or suggest side faces disposed perpendicularly with respect to the radiation exit face. Further, Kinoshita actually teaches away from having side faces disposed perpendicularly with respect to the radiation face. Specifically, in paragraph [0043], Kinoshita states: "In surface emitting lasers, in general, side surfaces perpendicular to the waveguide direction of the laser light may cause useless and undesirable resonance. To overcome this problem, the invention proposes various types of construction not making vertical side surfaces." Kinoshita discloses an angle between the side surface and the major surface, not an angle between the side surfaces and the crystal directions. Specifically, in paragraph [0056], Kinoshita states "side surfaces (60') of the device including edges of the active layer (3) and the waveguide layer (5) are configured to slant relative to the major surface of the

substrate (1)...With this slant facet structure, undesirable horizontal resonance by reflection from edges can be restricted". Therefore, Kinoshita explicitly teaches away from using perpendicular side surfaces as this would result in undesirable horizontal resonance. In view of Kinoshita's explicitly teaching away from using perpendicular side surfaces, Applicants submit that the combination of Kinoshita and Shveykin is improper.

In the Advisory Action, the Examiner states that Kinoshita discloses that it is conventional that the side surface of the active layer be perpendicular to the top surface of the active layer. The Examiner further states that Kinoshita provides clear evidence that one skilled in the art would have expected the side faces to be disposed perpendicularly with respect to the radiation exit face because this arrangement was conventional at the time of Applicants' invention.

However, as recited in Applicants' amended independent claim 1, the claimed invention includes both features (a) and (b) listed above, i.e., at least one of the side faces is disposed obliquely with respect to the principal crystal directions and perpendicularly with respect to the radiation exit face. If the slanted side faces taught by Kinoshita were replaced with side faces disposed perpendicularly with respect to the radiation exit face, as shown in Figs. 7A and 7B of Kinoshita, the result would be a cylindrical side face running in parallel to the crystal direction, which is perpendicular to the substrate (2). This configuration would not result in above-listed feature (a), i.e. "at least one of the side faces disposed obliquely with respect to said principal crystal directions", as recited in Applicants' independent claim 1. Furthermore, Kinoshita explicitly points out that the side faces should extend obliquely with respect to the surface (1) (which is the radiation exit face). Therefore, Kinoshita does not teach or suggest disposing the side faces obliquely with respect to the crystal directions (feature (a)) and to simultaneously

dispose the side face perpendicularly with respect to the radiation exit face (feature (b)), as recited in Applicants' amended independent claim 1.

Further, the device taught by Shveykin is not a surface emitting laser (i.e. a coherent light source, based on stimulated emission, i.e., LASER: Light Amplification by Stimulated Emission of Radiation), as is the case in the Kinoshita reference. Instead, Shveykin teaches an incoherent emitter. The device taught by Shveykin is based on spontaneous emission (see paragraph [0128] of Shveykin). Because of this fundamental difference, one skilled in the art would not have considered combining the teachings of Kinoshita with the teachings of Shveykin.

The Examiner cites paragraph [0128] of Shveykin, which teaches that the side faces of the device are designed such that radiation reflected off the side surface exits from the surface, as motivation to modify the device taught by Kinoshita by incorporating a side face perpendicular to a radiation exit face to increase brightness, as taught by Shveykin.

This motivation asserted by the Examiner, however, is not a concern expressed by Kinoshita. Instead, Kinoshita explicitly states that with "these slanted side surfaces, it is ensured to prevent undesirable horizontal resonance and invite vertical resonance alone" (see paragraph [0047] of Kinoshita). Hence, the goal of Kinoshita is not to maximize the brightness but instead to have pure vertical resonances. Therefore, the Examiner's so-called motivation to combine the references is neither reasonable nor realistic.

Moreover, Shveykin does not teach or suggest side faces arranged perpendicularly with respect to the radiation exit face in order to improve brightness. According to paragraph [0128] (cited by the Examiner), radiation reflected off the side surface is emitted "in a direction perpendicular to the surface". For this purpose, the side surface is conical (see Figs. 2 and 8 of Shveykin). Furthermore, Shveykin is silent regarding how the side surface is disposed with respect

to the principal crystal directions.

In view of the foregoing, Kinoshita and Shveykin, whether taken alone or in combination, do not teach or suggest the subject matter recited in Applicants' independent claim 1. Specifically, Kinoshita and Shveykin do not teach or suggest side faces disposed obliquely with respect to crystal directions and perpendicularly with respect to the radiation exit face, as recited in Applicants' independent claim 1. Accordingly, independent claim 1 is patentable thereover under 35 U.S.C. §103(a).

Dependent claims

Claims 2-9, which depend directly or indirectly from the independent claim 1, incorporate all of the limitations of independent claim 1 and are therefore deemed to be patentably distinct over Kinoshita and Shveykin for at least those reasons discussed above with respect to independent claim 1.

Claim 15 is allowable over Kinoshita under 35 U.S.C. §102(e)

The Office Action alleges that Kinoshita teaches all of Applicants' recited elements.

Independent claim 15 has been amended to point out more clearly the subject matter that Applicants regard as the invention. Specifically, independent claim 15 has been amended to recite a surface emitting semiconductor laser chip. The semiconductor laser chip includes a semiconductor body having a radiation exit face, a crystal structure having principal crystal directions extending along a lateral direction of the radiation exit face, and side faces laterally delimiting the semiconductor body. At least one of the side faces is disposed obliquely with respect to the principal crystal directions, and at least one of the side faces forms an angle of between 40°

and 50° with the at least one principal crystal direction within a plane running parallel to the radiation exit face (i.e., plan view). Support for the claim amendment can be found, at least, in Figure 3 of Applicants' specification.

Kinoshita fails to teach or suggest that "at least one of said side faces forms an angle of between 40° and 50° with said at least one principal crystal direction within a plane running parallel to the radiation exit face."

The side faces taught by Kinoshita "are configured to slant relative to the major surface" (see paragraph [0056] of Kinoshita) such that there is an angle between the side surface and the major surface (i.e., the side faces have an angle with respect to the major surface in side view).

Although Kinoshita (see Fig. 4) discloses an angle of 45° within a plane running parallel to the radiation exit face (i.e., plan view), this angle refers to the orientation of the waveguide (300) with respect to the cleaved edges (see paragraph [0077] of Kinoshita). Theses edges described in Kinoshita represent the side faces. In contrast, the limitation in Applicants' amended independent claim 15 refers to the angle between the side faces and the principal crystal directions.

In Kinoshita, the cleaved edges are shown in Fig. 4 and run parallel to the side faces of the laser emitting element. As described in paragraph [0004] of Applicants' specification, breaking lines run along principal crystal directions when cleaving semiconductor chips. This means that in the plan view shown in Fig. 4 of Kinoshita, the cleaved edges run along principal crystal directions. Therefore, Kinoshita teaches side faces that have a 0° angle with respect to the principal crystal directions in plan view. In sharp contrast to Kinoshita, Applicants' amended claim 15 recites "at least one of said side faces forms an angle of between 40° and 50° with said at least one principal crystal direction within a plane running parallel to the radiation exit face".

In view of the foregoing, it is respectfully submitted that Kinoshita does not teach or suggest the subject matter recited in Applicants' independent claim 15. Accordingly, claim 15 is patentable thereover under 35 U.S.C. §102(e).

Moreover, the above-presented differences between claim 15 and Kinoshita serve to clearly define the claimed invention as unobvious thereover under 35 USC 103.

Conclusion

In view of the foregoing, reconsideration and withdrawal of all rejections, and allowance of all pending claims is respectfully solicited.

Should the Examiner have any comments, questions, suggestions, or objections, the Examiner is respectfully requested to telephone the undersigned in order to facilitate reaching a resolution of any outstanding issues.

Respectfully submitted,

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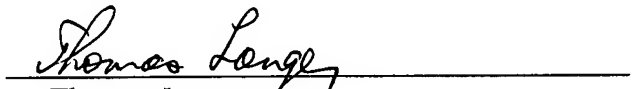
By 

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